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### Subarachnoid haemorrhage

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## Evidence based diagnosis

### We may need to be open to new ideas

EDITOR—If evidence based diagnosis is still in the dark ages, as Delamothe writes,<sup>1</sup> then so is evidence based treatment. The doctor's job is to choose the right treatment. If the diagnosis is wrong then the treatment will be wrong. Inaccurate diagnoses will also affect clinical trials. A treatment may be "evidence based" because it has worked in a published study, but some patients who would have responded might have been left out because of diagnostic inaccuracy while some patients with no prospect of responding might have been included incorrectly.<sup>2</sup>

Evidence based diagnosis is about convincing others using shared rules of evidence that a diagnosis (and its implications in terms of treatment) should be accepted by others. Evidence is gathered from the individual and from groups of patients.<sup>3</sup> Evidence based diagnosis means specifying the individual's facts in addition to pointing to facts relating to that diagnosis in the literature.<sup>4</sup>

Bayes's theorem uses unconditional initial prior probabilities. Diagnostic leads are based on conditional probabilities and are used to initiate diagnostic thought processes.<sup>4</sup> However, closely related theorems can be used to interpret diagnostic leads, which allow doctors to reason with diagnostic evidence in a more familiar way,<sup>3</sup> thus reducing misunderstandings.<sup>5</sup> So to improve evidence based diagnosis we also need to collect better data on diagnostic leads.

The published evidence given for a diagnosis and any related actions cannot realistically be assembled when actually seeing a patient. A draft evidence based rationale might be prepared in advance. It would have to be capable of being accessed in seconds to provide evidence in support of a suspected diagnosis and decision arrived at by using kindness, imagination, and common sense. It could be put into context by inserting the patient's details into the draft evidence summoned up from a computer. If we are to make progress and allow evidence based diagnosis to emerge from the dark ages then in addition to doing more of the same, we may also have to be receptive to new ideas.

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Competing interests: None declared.

- 1 Delamothe T. Diagnosis—the next frontier [Editor's choice]. *BMJ* 3006;333:0-6. (26 August.)
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- 4 Llewelyn H, Ang H, Lewis K, Al-Abdullah A. *The Oxford handbook of clinical diagnosis*. Oxford: Oxford University Press, 2006.
- 5 Bianchi MT, Alexander BM. Evidence based diagnosis: does the language reflect the theory? *BMJ* 2006;333:442-5. (26 August.)

### Multiple tests with multiple responses are important

EDITOR—Diagnostic reasoning is never carried out by using a single test alone: doctors should take a history first, do an examination, then do the tests.<sup>1</sup> Each stage adds variables to a multivariable rather than a univariate prediction process, already well recognised in prognostic studies.<sup>2</sup>

Using log<sub>10</sub> likelihood ratios and assuming independence of the predictor variables is appealing to me.<sup>3</sup> Computer scientists would use the log<sub>2</sub> unit, the information bit. This method seems to be equivalent to the naive bayesian classifier, used for filtering out spam mail, and is relatively easy to program.

The tests often have more than just a single purpose—for example, some recent electronic responses have argued about performing lumbar puncture for scan negative, rapid onset headache.<sup>4</sup> It is not just for diagnosing or excluding subarachnoid haemorrhage but relevant to diagnosing meningitis. Binary outcome logistic models do not reflect clinical reality. That is why clinical medicine is harder than mathematics.

You might have to go back to the patient to clarify the history and examination in light of unusual test findings. The real diagnostic process is nowhere near as linear and directed as implied in the research protocols.

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- 1 Bianchi MT, Alexander BM. Evidence based diagnosis: does the language reflect the theory? *BMJ* 2006;333:442-5. (26 August.)

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### Terminology is unsatisfactory

EDITOR—Undoubtedly the failure of diagnostic theory to catch on is partly due to unsatisfactory terminology.<sup>1</sup> "Sensitivity," and to a lesser extent "specificity," are words of multiple meanings that can be confusing in the context of test evaluation. The terms "true positive rate," "true negative rate," "false positive rate," and "false negative rate" are much less ambiguous. Likelihood ratios are also more easily understood, comparing as they do the proportions of positives or negatives in the diseased with the reference population. These are the "weights of evidence" defined by Pierce.<sup>2</sup> It can be helpful too to recall that odds ratios are the ratio of the positive and negative likelihood ratios—ratio-cination with a vengeance.

"Positive predictive value" is another term best discarded. "Posterior probability (or odds)" emphasises the process as well as the outcome. Nevertheless, the probabilists would do well to remember that many clinical rules of thumb include a dimension of utility. "Never diagnose a condition you can't treat" is an irritating

remark that is difficult to confute.

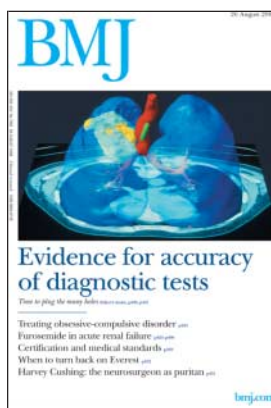
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- 1 Bianchi MT, Alexander BM. Evidence based diagnosis: does the language reflect the theory? *BMJ* 2006;333:442-5. (26 August.)
- 2 Fitelson B. A bayesian account of independent evidence with applications. *Philosophy of Science (Proceedings)* 2001;S123-140.

### Prior probability saves money, time, and possibly lives

EDITOR—Bayesian concepts of prior probability come to the aid of clinicians who aim to expedite diagnosis and treatment.<sup>1</sup> In one series comprising 63 patients in whom the final diagnosis was choledocholithiasis, four patients in whom this diagnosis was subsequently validated by endoscopic retrograde cholangiopancreatography bypassed



ultrasonography purely on the strength of the index of clinical suspicion—that is, prior probability—on the basis of their clinical and biochemical stigmata.<sup>2</sup> Rightly so, given that ultrasonography may itself be falsely negative for stigmata such as dilatation of the common bile duct or calculi in the common bile duct.<sup>3,4</sup> Potentially life saving treatment is also expedited by bypassing potentially redundant “routine” investigations—an important issue for patients with ascending cholangitis.<sup>5</sup>

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- 1 Bianchi MT, Alexander BM. Evidence based diagnosis: does the language reflect the theory? *BMJ* 2006;333:442-5. (26 August.)
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### What about the patients?

EDITOR—Test results are not just of interest to clinicians.<sup>1</sup> Patients are commonly told, “Your blood results were absolutely normal.” Although clinicians may know exactly what this phrase is intended to mean, patients are likely to interpret it differently. The test may have been a full blood count with urea and electrolytes, but the “your blood is normal” message may be interpreted as meaning that everything in the blood is normal—possibly up to and including HIV status.

Such a message may have profound healthcare implications. In an ideal world, this phrase would never be used. In reality, it is used all the time. The timely focus that Bianchi and Alexander have put on diagnosis and investigations may be an opportunity to deal with this use of terminology.

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Competing interests: DAH is national clinical adviser, Healthcare Commission.

- 1 Bianchi MT, Alexander BM. Evidence based diagnosis: does the language reflect the theory? *BMJ* 2006;333:442-5. (26 August.)

### Subarachnoid haemorrhage: lumbar puncture for every negative scan? Authors’ reply

EDITOR—Coats suggests that a lumbar puncture should not be undertaken after a negative computed tomogram for every patient with “query subarachnoid haemorrhage.”<sup>1</sup> We robustly disagree.

Firstly, in his bayesian calculations, Coats used the sensitivity of computed

tomography for identifying subarachnoid blood at 12 hours after onset of headache (98%). Sensitivity decays rapidly within days, so patients who do not present immediately, or who have to wait for computed tomography, are less likely to be identified, and the importance of a subsequent lumbar puncture cannot be overstated. Furthermore, computed tomography is often interpreted by junior, non-specialist radiologists, who are more likely to miss subtle signs of subarachnoid blood than senior specialist neuroradiologists. We see a steady trickle of patients whose subarachnoid haemorrhage was identified in a district general hospital on the basis of a lumbar puncture, after a normal report of their scan, but review of the scan confirms the presence of subarachnoid blood. These patients would not have been diagnosed, and might subsequently have had a fatal re-bleed had the clinicians not done a lumbar puncture.

Secondly, Coats assumes lumbar puncture is performed only to exclude subarachnoid haemorrhage, yet it may be the key to diagnosing other causes of sudden headache, such as meningococcalitis and intracranial venous thrombosis (box 2 of our review).

Lastly, we are intrigued by the notion that doctors might enter into a bayesian debate with a frightened, distressed, vomiting patient in the hectic environment of the emergency department. Without wishing to sound paternalistic, patients are likely to prefer their doctors to quickly and accurately diagnose what is wrong with them, rather than debate the merits of not conducting a low risk diagnostic procedure for a potentially life threatening neurological disease.

In a perfect world, all patients with sudden onset headache would present immediately for senior specialist medical attention and lie completely still in a modern generation scanner, the scan would be performed within 30 minutes of their first assessment and immediately interpreted by an experienced consultant neuroradiologist. Acknowledging that such a state does not exist, we stand by our recommendation that all patients with a headache of maximal intensity either immediately or within minutes, lasting longer than an hour, and who have received a normal computed tomogram report, should have a lumbar puncture.

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Competing interests: RJD and KWL have acted as expert witnesses in cases involving subarachnoid haemorrhage. PMW has received reimbursement for expenses in attending international conferences from Siemens, Cordis, Boston Scientific, UK Medical, and

Microvention; has been reimbursed by Pyramed UK for running an educational programme; and holds a research grant from Microvention funding a randomised controlled trial (hydrocoiled endovascular aneurysm occlusion and packing study). PMW has received consulting fees from Boston Scientific, Cordis, UK Medical, and Microvention.

- 1 Coats TJ. Subarachnoid haemorrhage: lumbar puncture for every negative scan. *BMJ* 2006;333:396-7. (19 August.)

### Strange things happen when we never qualify the frequency

EDITOR—Aronson illustrated that the definition of frequency qualifiers cannot be taken for granted.<sup>1</sup> However, we often omit them completely as we condense complex research findings into terse one liners. This can dramatically distort our perception of risk.

For example, nobody would disagree that non-steroidal anti-inflammatory drugs (NSAIDs) are an important cause of avoidable iatrogenic mortality in elderly patients, largely through ulceration and perforation of the upper gastrointestinal tract. These ideas profoundly influence prescribing: doctors may avoid their use altogether or co-prescribe prophylactic measures.

Reputable studies show that, for NSAID users over the age of 75, the annual risks for serious gastrointestinal bleed and death are 1 in 110 and 1 in 650, respectively, and that there is one episode of ulcer bleeding in elderly people for every 2823 NSAID prescriptions.<sup>2,3</sup> At least 83 patients need misoprostol prophylaxis to prevent one NSAID-related gastrointestinal bleed, although a subsequent systematic review was unable to calculate any figure from the available evidence.<sup>4,5</sup>

Using Aronson’s table of what frequency qualifiers presently mean to people, we would have to say that NSAIDs “never” cause the problems described above, and the most effective prophylactic measure against these risks “never” works. Well I never.

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Competing interests: None declared.

- 1 Aronson J. Sometimes, never. *BMJ* 2006;333:445. (26 August.)
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## Early intervention in acute renal failure

### Assessing fluid status is important

EDITOR—Bennett-Jones suggests that doctors take a pragmatic and prompt approach to intravenous fluid replacement, based on the patient's blood pressure, capillary refill time, and venous filling.<sup>1</sup> Assessment of fluid status needs to be much broader and incorporate a full history of any fluid gains and losses from the patient, relatives, nurses, fluid balance charts, prescription charts, anaesthetic records, and daily weights. The patient should be assessed for symptoms of hypovolaemia, which can include postural dizziness, thirst, dry mouth, reduced urine output, feeling cold, shivering, shortness of breath, and altered mental state.

Furthermore, in examining the patient, of central importance are blood pressure, a postural fall in blood pressure, tachycardia (or rarely bradycardia with severe hypovolaemia) and postural changes in pulse rate, whereas capillary refill time is not of proved diagnostic value in adults.<sup>2</sup> Other signs that should be sought are jugular venous pressure, pallor, peripheral perfusion, the dryness of mucous membranes, and the presence of pulmonary and peripheral oedema. If doubt about volume status remains, central venous pressure monitoring should be considered.

This careful assessment of fluid status is crucial before the instruction to give intravenous fluids, not loop diuretics to avoid patients developing dangerous pulmonary oedema, particularly since in some studies fluid loading in intensive care has been associated with a higher incidence of acute renal failure.<sup>3</sup>

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Competing interests: None declared.

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### Evidence of inadequate intravenous fluid treatment in UK hospitals

EDITOR—Bennett-Jones emphasises the importance of prompt administration of intravenous fluids for early intervention in acute renal failure.<sup>1</sup> Determining the appropriate rate of fluid administration must include an estimate of the degree of intravascular volume depletion at the start of treatment, with most aggressive volume expansion targeted at patients with the greatest deficits. To determine whether this simple principle is followed in practice, we audited intravenous fluid prescriptions for 114 consecutive acute surgical admissions to three UK centres (one teaching hospital and two district general hospitals).

A raised ratio of blood urea to creatinine is commonly used as a quantitative reference standard for the diagnosis of hypovolaemia,<sup>2</sup> and similar rises may be seen in patients with reduced effective intravascular volume secondary to sepsis.<sup>3</sup> We therefore compared the initial rate of intravenous fluid administration for each patient with their urea:creatinine ratio on admission. We excluded from the analysis patients with chronic renal failure or upper gastrointestinal haemorrhage, or who were taking drugs known to affect this ratio.

Across all admissions, the volume of fluid prescribed over the first hour of treatment ranged from 83 ml to 1250 ml. The degree of correlation between rate of administration and urea:creatinine ratio was low, with a correlation coefficient for the complete data set of only 0.23 (95% confidence interval: 0.05 to 0.40). This indicates that just 5.3% of the variation in rate of fluid administration can be explained by an association with urea:creatinine ratio (and hence degree of intravascular volume depletion).

The most likely explanation for this finding is a failure by the admitting doctors to appropriately diagnose and treat hypovolaemia. In UK hospitals, fluid prescription is typically left to the most junior members of medical and surgical teams, among whom inadequate knowledge is common.<sup>4</sup> Training and practice clearly need improving, and courses such as ALERT (acute life-threatening events—recognition and treatment) may be a good start.<sup>5</sup>

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We thank Nicola Alder, medical statistician at the Centre for Statistics in Medicine, Oxford, for her help with data analysis.

Competing interests: None declared.

- 1 Bennett-Jones DN. Early intervention in acute renal failure. *BMJ* 2006;333:406-7. (26 August.)
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## Exempting mental health units from smoke-free laws

### Nicotine can have beneficial effects

EDITOR—Campion et al argue that psychiatric units should not be exempt from smoking bans, but they do not discuss several issues.<sup>1</sup>

Nicotine can have beneficial effects on mood, anxiety, and cognition, and it ameliorates

some of the side effects of psychotropic drugs. Acute nicotine withdrawal can exacerbate psychiatric symptoms and cause diagnostic difficulty. Cigarette smoke also induces the metabolism of many different psychotropic drugs.<sup>2</sup> Therefore, enforcing acute smoking cessation in mentally unwell patients may cause serious problems, including making the patient feel worse, clouding the clinical picture, worsening the side effects of prescribed drugs, and precipitating drug toxicity. When the patient starts smoking again after discharge, the risk of relapse is increased (secondary to re-stimulation of the hepatic microsomal enzyme system and associated reduction in plasma concentrations of prescribed drugs).

To enforce a smoking ban on patients who are free to leave hospital and who stay of their own volition may be considered acceptable. However, to enforce this on patients who are detained against their will under mental health legislation seems unreasonable, especially in Scotland where the principles of least restrictive alternative and reciprocity are recognised.<sup>3</sup>

Even in studies where motivated patients use smoking cessation aids in the absence of acute mental illness, only the minority remain abstinent in the medium to long term. Is there any clear evidence that enforcing a blanket smoking ban on acutely unwell psychiatric patients will result in longer term benefit for them in the real world?

I would love to live and work in a smoke-free environment. However, I remain unconvinced that we are treating patients as we ourselves would wish to be treated if we ban them from smoking against their will when mentally ill. It is one thing to help smokers give up when they are well enough to make an informed choice for themselves. It is quite another to enforce a smoking ban on acutely unwell patients.

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Competing interests: None declared.

- 1 Campion J, McNeill A, Checinski K. Exempting mental health units from smoke-free laws. *BMJ* 2006;333:407-8. (26 August.)
- 2 Taylor D, Paton C, Kerwin R. *The Maudsley 2005-2006 prescribing guidelines*. 8th ed. London: Taylor and Francis, 2006.
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### Issue should no longer be ignored

EDITOR—Campion et al wrote on no longer exempting mental health units from smoke-free laws.<sup>1</sup> By allowing smoking in psychiatric units the government will only increase stigma towards psychiatric patients when the Royal College of Psychiatrists is trying hard to reduce it.

Admission of smokers with mental illness to smoke-free psychiatric units may lead to behavioural deterioration, but some evidence from the United States refutes this argument. In 1987 the Board of Trustees of Southwest Washington Hospitals instituted

a smoking ban in all of its facilities, including general psychiatry units. The changes were introduced successfully with minimal impact on the successful function of the psychiatric service.<sup>2</sup> The implementation of a smoking ban, establishing a smoke-free psychiatric service and abolishing tobacco products, created minor management difficulties on a locked psychiatric unit.<sup>3</sup>

The effects of prohibiting cigarette smoking on the behaviour of patients on a 25 bed psychiatric inpatient unit were assessed immediately after implementation of a smoking ban and two years later. No major behavioural disruptions were observed after the ban. The number of calls for security assistance, physical assaults, instances of leather restraints and of seclusions, and discharges against medical advice did not increase significantly immediately after the restriction on smoking or two years later.<sup>4</sup>

Signs and symptoms of nicotine withdrawal and alterations in psychopathology were evaluated among acutely ill psychiatric patients admitted to a hospital with a smoking ban.<sup>5</sup> Despite subjects' reports of feeling distressed and of experiencing nicotine withdrawal symptoms, abrupt cessation of smoking did not significantly affect either the severity or the improvement of psychopathological symptoms during admission. The authors report no compelling reasons to reverse the smoking ban.

With the growing concern for the harmful effects of cigarette smoking and passive smoking and the evidence above, exemptions for mental health units from smoke-free laws can no longer be ignored.

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- 1 Campion J, McNeill A, Checinski K. Exempting mental health units from smoke-free laws. *BMJ* 2006;333:407-8. (26 August.)
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- 5 Smith CM, Pristach CA, Cartagena M. Obligatory cessation of smoking by psychiatric inpatients. *Psychiatric Services* 1999;50:91-4.

## HIV cannot be tackled in isolation

EDITOR—The news extra by Clark with much of the evidence on delivering health care for HIV in less developed countries highlights a key issue in all such countries.<sup>1</sup> To raise one part of the country (one service, one sector such as education or health) to a much higher level is impossible without raising the whole economy.

Health professionals, even if well paid, are unlikely to want to work in areas where their children cannot get a good education

or where they cannot rely on an energy supply at work or at home. Road safety alone poses a major threat in many less developed countries, as well as crime and civil unrest.

Faced with these additional "costs" of working in such countries, many will choose to go elsewhere, if only to more comfortable cities in the same part of the world. The developed world needs to come to terms with its failure to do enough to raise general standards of living, education, and public health and safety in less developed countries. Until that happens, pouring large amounts of money into single "vertical" disease programmes will not transform the health prospects of populations of less developed countries.

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Competing interests: York Health Economics Consortium is a contract research company owned by the University of York. It has a range of public and private sector clients but is not active in relevant research fields on HIV in the third world. PAW has worked extensively on the cost effectiveness of HIV prevention but is not doing so currently. Past research has been funded by the Overseas Development Institute and Department for International Development and non-governmental agencies in HIV prevention.

- 1 Clark J. HIV programmes in poor countries lack health workers [News extra]. <http://bmj.bmjournals.com/cgi/content/full/333/7565/412-d> (accessed 31 Aug 2006.)

## Three Bs, please

### Don't despise excellence

EDITOR—Choosing medical students is more difficult than it might seem at first glance.<sup>1</sup> Lowering entrance requirements for medical school is not the answer—medical school and subsequent medical practice require intellect and application. Equally, favouring mature students with a first degree or qualification in time may lead to a situation where a pre-med qualification becomes an advantage and may discriminate against school leavers.

Perhaps the fairest way to level the playing field between state and private schools is to introduce a standardised national qualification for entry to medical school entry, in addition to A level results. In that way, problem solving skills, knowledge, and emotional intelligence could all be assessed, without fear of bias towards one group.

In the meantime, to make excuses for the failure of the state school system to achieve good A level grades, by suggesting that the private schools are "puffed up," is not helpful. Rather, ask why state schools achieve such low results, even with recent huge increases in funding? Private schools can be academically selective, tend to have smaller classes, be better disciplined, and have more motivated pupils and parents—but why attack a system that appears to be doing the job better?

It may be socially rewarding for Spence to identify with what he sees as the underdog, but with such an important issue as this, perhaps it is time for all of us to put aside our outdated social prejudices and just try to get the best result.

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- 1 Spence D. Three Bs, please. *BMJ* 2006;333:453. (26 August.)

### More academic excellence, please

EDITOR—Spence's article highlights a growing divide in the perception of who the doctors of tomorrow should be.<sup>1</sup> On the one hand, we hear the cry for more students with lower grades who have "the gift of the gab, blarney, patter, or a silver tongue" (although whether there is any evidence base on which to support an association between these attributes and low grades seems dubious).

At the same time, medicine needs students of an academic bent more than ever. We need doctors who are at home in the world of primary research, who aspire to further the limits of our knowledge, who have a scientific approach to their profession, and the ability to accept uncertainty and reassurance.

When As make up 24.1% of all A levels now awarded, surely to lower the requirements even further would remove an important and useful hurdle for admissions panels: are you motivated enough to achieve the necessary grades?

Interviews are the appropriate point at which to assess a student's personality rather than when surveying his or her grades. To label all those students who want to go into medicine and were willing to work to achieve the necessary grades "neurotics" or "no-social-skills types" is too absurd to be offensive. Should Spence wish to verify the accuracy of that statement, he has an open invitation to dinner with the students in my house (who have not a B grade between us).

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Competing interests: More than three Bs at A level.

- 1 Spence D. Three Bs, please. *BMJ* 2006;333:453. (26 August.)

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